

# Influence of phenolics on white wine quality and style

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***The importance of phenolic compounds in red wine colour and texture is well known. For white wines the story has not been as well understood. Texture in white wines is seen as positive, but coarseness and hardness are not. AWRI researchers have studied the effects of phenolics in commercial white wines, finding out about their effects on wine style, consumer liking and winemaker assessments.***

## INTRODUCTION

Many Australian winemakers now actively embrace winemaking processes that incorporate phenolics into their white wines. This is done to enhance palate texture, and make wines that are 'food-friendly'. The choice to boost phenolics depends greatly on the wine style that the winemaker intends to produce. Phenolic characters are not generally desirable in lighter styles of Riesling, unwooded Chardonnay and Sauvignon Blanc. Their presence is thought to detract from the fresh fruit characters valued in these styles. In addition, the darker colours and astringent, oily and bitter tastes often found with higher concentrations of phenolics are not well regarded in these wines. In contrast, some other varieties such as Pinot Gris, Chardonnay or Viognier are often made in a way to intentionally incorporate higher phenolic levels with the view to creating more textural wines. Even in fuller-bodied styles, however, there is a fine line between positive textural characters and undesirable coarseness.

Two studies have investigated the influence of phenolics in commercial white wine. The first focussed on Pinot Grigio/Gris (abbreviated to Pinot G), and examined the role of phenolics in contributing to Pinot G wine style. The second study explored how phenolics and other wine compositional factors related to consumer liking of white wines and winemaker assessments of white wine quality.

## COMPOSITION AND STYLE

Pinot G is an obvious variety to consider when investigating the influence of composition on white wine style. It is grown across Europe, but is most well known in northern Italy and the Alsace region of France where two very different wine styles have traditionally been made, labelled Pinot

### AT A GLANCE

- Phenolic compounds in white wines are known to contribute to astringency, hotness, oiliness, viscosity and bitterness, but their effects are influenced by overall wine composition
- Two studies investigated the effect of phenolics in commercial white wines – one focussing on Pinot Grigio/Gris wines and one covering a range of white varieties
- Perception of Pinot G wine style was strongly related to total phenolics, alcohol and residual sugar
- Consumer liking of white wines was influenced more by sugar and alcohol than by phenolics
- Winemakers associated higher quality of white wines with lower alcohol and higher quality of Riesling wines with lower alcohol and lower phenolics

Grigio and Pinot Gris, respectively. In Italy, grapes are harvested early, maintaining high acid levels and producing wines with subtle varietal characters, light body and crisp acidity. In Alsace, grapes are left to ripen longer, juices are fermented on solids and pre-fermentation skin contact is common, resulting in wines with higher phenolics and alcohol levels, richer flavours and greater overall palate fullness. While the higher alcohol typical of the Alsatian style may cause greater palate fullness compared with the lighter Italian style, it wasn't known if higher phenolics also contributed to wine mouthfeel or style.

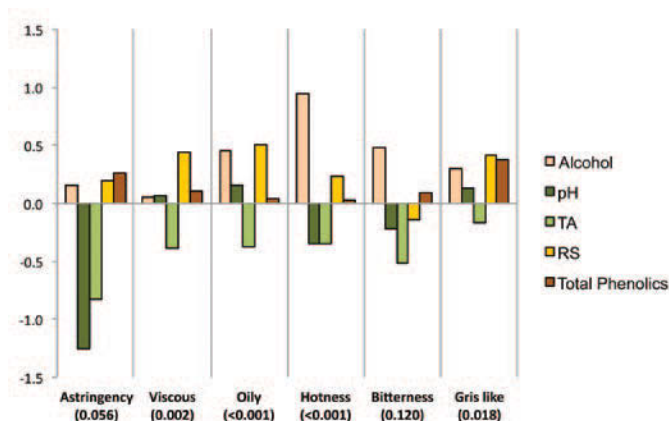
To find out, 22 commercial Pinot G wines were chosen for tasting and analysis: 18 Australian, three Alsatian and one from New Zealand. The wines were chosen to cover a diverse range of styles ranging from the fuller bodied, higher alcohol style to the lighter bodied, lower alcohol, high acid style. Tasters rated the wines for a range of agreed attributes, including mouthfeel attributes that are commonly associated with 'phenolic character' in white wine: astringency, viscosity, oiliness, hotness and bitterness. They were also asked to indicate where they thought each wine sat in the continuum from traditional Grigio

to traditional Gris. The wines tasted were analysed for alcohol, pH, titratable acidity (TA), residual sugar and total phenolics. Statistical analysis was used to relate the sensory and compositional data.

### Linking analytical and sensory results

Table 1 and Figure 1 summarise the associations between the analytical results and the mouthfeel ratings of the tasters. Viscosity and oiliness were found to be associated with residual sugar, while oiliness and hotness were also associated with alcohol. As reported in AWRI publication #1518, astringency in the Pinot G wines was best related to lower pH and lower TA (Figure 1). Total phenolics appeared to be less important than acidity in determining the astringency of this set of Pinot G wines.

In general, the major wine compositional variables – pH, TA, residual sugar and alcohol – explained the variations in mouthfeel and bitterness better than the phenolic content (Figure 1 and Table 1). However, while total phenolics did not strongly influence any particular sensory attribute, it was important for the overall perception of style (Figure 1 and Table 1). Total phenolics had a positive (if weak)



**Figure 1. Statistical analysis of associations between sensory attribute ratings and analytical parameters. Positive associations are shown above the middle line, and negative associations are shown below the middle line. Significance of the statistical model fit is given in parentheses.**

effect on all the individual attributes that are typically associated with 'phenolic character', which in combination may have contributed to an overall perception that a wine was more Gris-like than Grigio-like.

Pinot G winemakers interested in pursuing particular wine styles now have a greater understanding of which compositional factors are most important and can consider steps to take in the vineyard or winery to influence them. Wine style can also be communicated directly to consumers using the Pinot G Style Spectrum labelling tool.

#### WHAT DO WINEMAKERS AND CONSUMERS THINK ABOUT PHENOLICS IN WHITE WINE?

Few consumers would be familiar with the term phenolics, particularly in regard to white wines. Winemakers, on the other hand, think and talk about phenolics as part of their work and would have a personal impression of what 'phenolic character' means. AWRI researchers were interested to investigate how these two very different groups would react to a set of wines with varying levels of phenolics.

Twenty-four Australian wines from the top 100 best-selling wines of 2009 were chosen through an initial screening process: seven unoaked Chardonnays, five oaked Chardonnays, 10 Rieslings, and two Pinot G wines. The wines were then tasted by a group of experienced Australian winemakers. The tasters were informed of the grape varieties of the wines before being asked to rate them for overall quality using the 20-point scale commonly used in Australian wine show judging. The tasters were also asked to indicate if the wines displayed 'phenolic character'.

Following the winemaker tasting, 14 of the 24 wines were selected for consumer testing. The wines chosen were eight Rieslings, two unoaked Chardonnays, two oaked Chardonnays and two Pinot G wines. The consumer panel comprised 203 Sydney consumers who consumed white wine at least once per week, and who occasionally purchased \$10-20 bottled white wine. The consumers were asked to taste the 14 wines and rate how much they liked them on a nine-point category scale (from 'like extremely' to 'dislike extremely'). The wines were also analysed for alcohol, pH, TA, residual sugar and total phenolics.

All of the sensory data (from both winemakers and consumers) were correlated against the analytical data. Data for the 10 Riesling wines tasted by the winemakers were also analysed as a separate set, to see if there might be any variety-specific effects. Finally, the proportion of winemakers that indicated that each wine had 'phenolic character' was correlated with the compositional data and average quality score.

**Table 1. Best subset regression for 'Pinot G' wines. Green fill indicates that a higher value of the compositional parameter contributed to explaining an increase in the intensity of the mouth-feel attribute, or being more Gris-like in style. Orange fill indicates that higher pH contributed to explaining a decrease in astringency.**

Composition	Alcohol	pH	TA	Residual Sugar	Total Phenolics	Model Fit
Astringency						0.17
Viscous						0.58
Oily						0.66
Hotness						0.79
Bitterness						0.21
Pinot G style						0.49

#### Consumers and winemakers don't always agree

The 14 wines tasted by the consumers were generally well-liked, with average scores out of nine in a narrow range between 5.95 and 6.58. The average quality scores from the winemakers for the 14 wines ranged from 14.9 to 15.5 and for the 24 wines, from 14.2 to 16.4. These scores indicated that the wines were of sound to good quality. The score ranges are consistent with the wines' popularity in the marketplace. ▶



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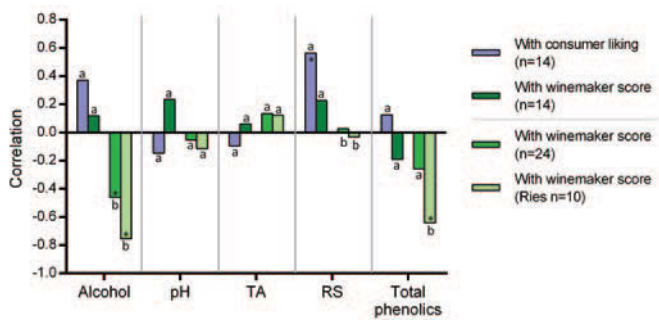
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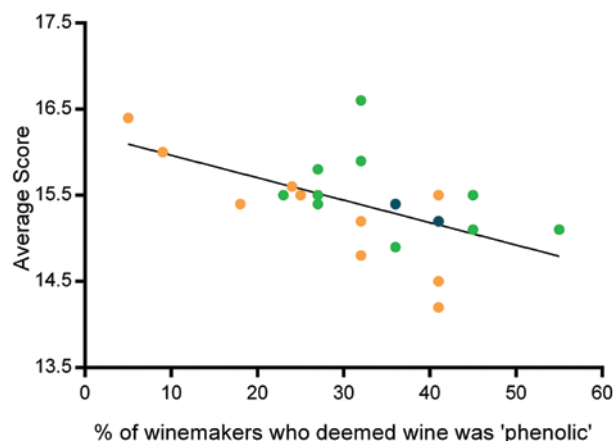


**Figure 2. Correlations between consumer liking, winemaker quality score and basic wine composition. \* indicates significant correlation ( $p < 0.05$ ) and different letters indicate significant differences in correlation.**

Figure 2, see page 36 shows the relationships between the consumer liking of the wines and the basic wine composition including total phenolics. Liking was most strongly and significantly associated with residual sugar (RS) content ( $r = 0.56$ ,  $p = 0.04$ ). Acidity parameters and total phenolic content were not associated with liking. A moderate but non-significant association ( $r = 0.37$ ,  $p = 0.19$ ) was also seen between consumer liking and alcohol content.

The winemakers' quality ratings for the 14 wines used in the consumer study were not strongly associated with any of the major aspects of wine composition (also shown in Figure 2). However, when the set of 24 wines was included, higher quality ratings were significantly associated with lower alcohol ( $r = -0.46, p = 0.02$ ). When the Rieslings were considered on their own, alcohol and phenolics had stronger associations with winemaker scores (Figure 2), which may suggest that the winemakers did not feel that high phenolics and high alcohol were consistent with Australian Riesling style.

The number of wines included in the consumer study was small, and in this report no attempt has been made to segment the



**Figure 3. Average winemaker quality score vs percentage of winemakers assessing wine as being 'phenolic' ( $r = -0.56$ ). Yellow=Chardonnay, Green=Riesling, Blue=Pinot Gris.**

consumer population. Therefore, differences between consumer liking and winemaker quality scores should be interpreted with caution. However, it appears that basic wine components (sugar and alcohol) were most important in determining consumers' liking of the wines, while winemakers also saw phenolic levels as being important in their quality assessments of white wines.

The role of phenolics in winemaker quality assessments was investigated further by relating the proportion of winemakers who thought that the wine tasted 'phenolic' to wine composition and to their quality scores (Figure 3). The proportion of winemakers reporting 'phenolic taste' was not significantly associated with any aspect of composition including total phenolics ( $r=0.17$ ). However, the relationship between phenolic perception and total phenolic concentration was stronger when only unoaked wines were considered ( $r=0.40$ ,  $p<0.05$ ), suggesting that phenolic character is more difficult to perceive in wines with oak influence.

The fact that lower average wine quality ratings by winemakers were more strongly associated with perceived phenolic character than actual phenolic concentration suggests that other components may contribute to the perception of characters normally associated with phenolics. Here, the percentage of winemakers reporting phenolic character was most strongly correlated with pH ( $r=-0.26$ ), a result which is consistent with other recent research [AWRI publication #1552].

## WHAT'S NEXT FOR TEXTURE?

Winemakers will continue to experiment with different levels of phenolics in white wine – seeking desired texture and wine style outcomes. The two studies presented in this report suggest that while phenolics can definitely influence wine style, their importance in consumer liking is secondary to basic wine composition. Quality assessment by other winemakers, for example in the wine show environment, is likely to be more strongly affected by phenolic characters, but wine composition still has a strong influence. At least for the group of winemakers involved in this work, Riesling wines with lower levels of phenolics and alcohol were seen as being of higher quality.

Wine texture and style are not simple concepts and can't be tied to one or two analytical measures. Instead, research is increasingly pointing to the importance of interactions between different wine components, and the strong influence of basic wine chemistry. The challenges of understanding these interactions will be pursued in the AWRI's continuing research on wine texture and style.

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